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ABSTRACT

Studies of human information processing have identified two basic ways people process information. Sequential learning solves problems by arranging small amounts of information in consecutive and linear order. Simultaneous processors solve problems by integrating and synthesizing parallel pieces of information at the same time. This study investigated whether methods of instruction interact with students' processing strengths and weaknesses. The question specifically addressed was, does the learning of vocabulary words increase when a method of instruction (sequential or simultaneous) is matched to the student's more efficient processing modality (sequential or simultaneous)? The Kaufman Assessment Battery for Children (KABC) was administered to 55 first and second grade students to determine their processing styles. Each subject was tested on the vocabulary words from the primary reading curriculum, and those words that were correctly identified were eliminated from the word list. The children were instructed by the two different instructional methods for eight consecutive week days. The study demonstrates a methodology that tests the utility of the KABC for making educational decisions. While some success was obtained, practitioners are advised to consider alternative assessment procedures that have empirical support, such as interventions that integrate systematic formative evaluation with instruction. (JD)

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# The Effects of Two Types of Instruction on Simultaneous and Sequential Processing

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# THE EFFECTS OF TWO TYPES OF INSTRUCTION ON SIMULTANEOUS AND SEQUENTIAL PROCESSING

## Introduction

As classroom teachers become increasingly responsible for curricular and instructional decisions, their understanding of how children acquire, integrate, and process information becomes correspondingly important. Cognitive psychologists who study the phenomenon of human information processing have identified two basic ways that people process information. These two types of processing which have been supported by factor analytic studies (Naglieri, Kamphaus and Kaufman, 1984), academic achievement (Leasak, Hunt & Randhawa, 1982), and shown to be disparate for disabled readers (Das & Cummins, 1982), are labeled sequential and simultaneous. Sequential learners solve problems by arranging small amounts of information in consecutive and linear order. Simultaneous processors solve problems by intergrating and synthesizing parallel pieces of information at the same time. In 1983 Kaufman & Kaufman published the Kaufman Assessment Battery for Children. The tests were designed to reveal whether a child solved problems more effectively by sequential or simultaneous processing. Because the battery focused upon the mental processing that children used to solve problems, rather than upon their prior knowledge, which was more apt to be environmentally influenced, the Kaufman battery was alleged to be less culturally based than the other traditonal I.Q. tests. The authors advocate using the test results to identify direct teaching methods that are

geared to the child's most efficient processing modality. This approach, labeled ATI for "aptitude-treatment interaction," was the technique employed to obtain the data for this paper.

Objectives

The major objective of this study was to investigate whether methods of instruction interact with students processing strengths and weaknesses. Specifically, does the learning of vocabulary words increase when a method of instruction (sequential or simultaneous) is matched to the student's most efficient processing modality (sequential or simultaneous)?

Sample

Subjects for the study consisted of first and second graders attending the Falk Laboratory School of the University of Pittsburgh. Falk School utilizes a multi-age grouping configuration with six and seven year old students in self-contained classrooms. This level is referred to as the Primary level.

Four doctoral students from the Department of Psychology in Education, at the University of Pittsburgh were trained to administer the Kaufman Assessment Battery for Children. Each child (n=55) was assessed individually by one of the four pre-service psychologists.

Procedure

Following the assessment phase of the study, subjects were placed in one of three categories based on their performance on the Kaufman Assessment Battery for Children, (KABC): a simultaneous processing strength group (SIM), a sequential processing strength group (SEQ), or

a mixed processing group (MPG). Of the 55 subjects assessed, 24 displayed a processing strength according to Kaufman's criteria. Of these 24 subjects, 6 displayed strength in simultaneous processing and 18 in suquential processing. The other 31 students exhibited mixed processing strengths. Of those 6 SIM subjects, 1 had left Falk School after the assessment phase and before the instructional phase, and 2 were not available for the instructional phase because of parental concerns. Thus, 3 subjects were available for the instructional phase who met Kaufman's criteria for SIM processing strength and 18 were available for the instructional phase who met Kaufman's criteria for SEQ processing strength. The 3 SIM students were matched on the KABC Mental Processing Composite to 3 SEQ students to form a group of 6 students for the instructional sessions.

A word list was generated from the primary reading curriculum. The word list was derived from the Houghton Mifflin (1982) reading scope and sequence, the Ginn 1981 series, and the New Reading Series, (NRS), University of Pittsburgh. Each subject was pretested on the vocabulary words and those words that were correctly identified were eliminated from the word list.

Prior to the instructional phase of the study protocols were designed based upon sequential and simultaneous processing methods of instruction. Protocols were constructed based upon the information presented in the Kaufman Sequential or Simultaneous (KSOS) inservice program designed to instruct teachers on how to match instructional strategies to a student's processing strength (Kaufman, Kaufman &

Goldsmith, 1984). Instructional protocols emphasizing simultaneous processing strengths relied heavily on recognizing the shape and physical appearance of the words, utilizing matching grids, and viewing whole through a window display. Instructional protocols emphasizing sequential processing strengths relied heavily on letter/sound correspondence, word ordering, and viewing words through a window-type framework so that words were displayed syllable by syllable.

The instructional phase lasted 8 consecutive week days. The SIM instructional treatment was started the first 4 days and the SEQ treatment followed on the next 4 days. Each instructional period had a duration of 20 minutes and taught 10 words per session. Post tests were administered after the 4 SIM instructional periods and after the 4 SEQ periods. During the entire instructional phase, neither the instructor nor the subjects had knowledge of the processing strengths of the individual students.

Results

The number of words read correctly per minute from the target word list was the dependent variable in a group by instruction mixed effects analysis of variance. Group was a between-subjects effect and instruction was a within-subjects effect. In this analysis, we were most interested in the group-by-instruction interaction. This effect provides direct information regarding the efficacy of matching instruction to processing strength. The main effect of group was not of interest because the findings do not provide information about matching instruction to processing strength. Similarly, the main effect

of instruction was not of interest because the finding again would not provide information about the efficacy of matching instruction to processing strength.

The mean number of words read correctly per minute under each type of instruction for each group is presented in Table 1 and graphically displayed in Figure 1. With the extremely small sample size, the group-by-instruction interaction was not significant, $F(1, 4) = 6.28$, $p = .066$. Although the interaction was not significant, an oddity emerged in the testing. Students performed in a fashion that was exactly the opposite from that predicted by the Kaufman Model. In particular, students with a strength in sequential processing performed better when presented with simultaneous instruction and students with a strength in simultaneous processing performed better with sequential instruction.

The performance of the six students under both methods of instruction was also examined individually. Figure 2 displays the number of words read correctly per minute for the three sequential processors when provided with sequential and again with simultaneous instruction, and for the three simultaneous processors when provided with both types of instruction. The group pattern of performance was the same as the pattern of performance for all individual students; all simultaneous processors performed better with sequential instruction and all sequential processors performed better with simultaneous instruction.

## Summary

This study demonstrates a methodology that tests the utility of the Kaufman Model and the K-ABC for making educational decisions. However, the study sample was too small to permit firm conclusions. While this examination of the Kaufman Model failed to support the utility of K-ABC for educational decision making, these results are insufficient to conclude that the Kaufman Model does not work. The K-ABC proposes to guide program-planning decisions for individual students, not large groups. This study documented 6 individual cases where the Kaufman Model did not facilitate student performance. If a robust effect on student achievement was attributable to the Kaufman Model, this study should have provided more favorable evidence.

The difficulties inherent in studying the Kaufman Model are formidable. First, a major investment of time and effort is necessary to select subjects to participate in these studies. In this study, 55 students were extensively and individually tested in order to obtain the sample of 6 students with whom the instructional treatments were implemented. The logistics of selecting materials for instruction, designing interventions and evaluating outcomes also were substantial. Nevertheless, empirical support for the Kaufman Model is essential before K-ABC results are used to guide program-planning decisions. Kamphaus and Reynolds (1988) stress that "the highest priority on our K-ABC research agenda is to determine the effectiveness of the K-ABC remedial model. We see this as one of the fundamental characteristics of the K-ABC that could make it truly different from other tests

"(p.172). Until empirical support is available, it seems appropriate to consider the Kaufman Model experimental with implementation in the schools premature.

Instead, practitioners would be well advised to consider alternative assessment procedures that have empirical support. In particular, interventions that integrate systematic formative evaluation with instruction have been shown to increase student achievement outcome measures by 0.7 standard deviations (Fuchs & Fuchs, 1986). This approach assumes that students learn best in different ways, but that identification of those procedures based on standardized test performance is not efficacious. When procedures are not effective with individual pupils, they should be modified. The evolving curriculum-based measurement (CBM) methodology is well suited to the direct, frequent, and repeated measurement of student progress (Deno, 1985; 1986).

Table 1

Mean Correct Words Per Minute for Sequential and Simultaneous Processors Given Sequential and Simultaneous Instruction

| | Instruction | |
|---|---|---|
| Group | Sequential | Simultaneous |
| Sequential Processors | | |
| Mean | 10.81 | 12.62 |
| SD | 0.27 | 1.91 |
| Simultaneous Processors | | |
| Mean | 7.37 | 6.74 |
| SD | 4.55 | 4.37 |

Note. Both groups based on n = 3.

**Figure 1**

*Effects of Sequential and Simultaneous Instruction*

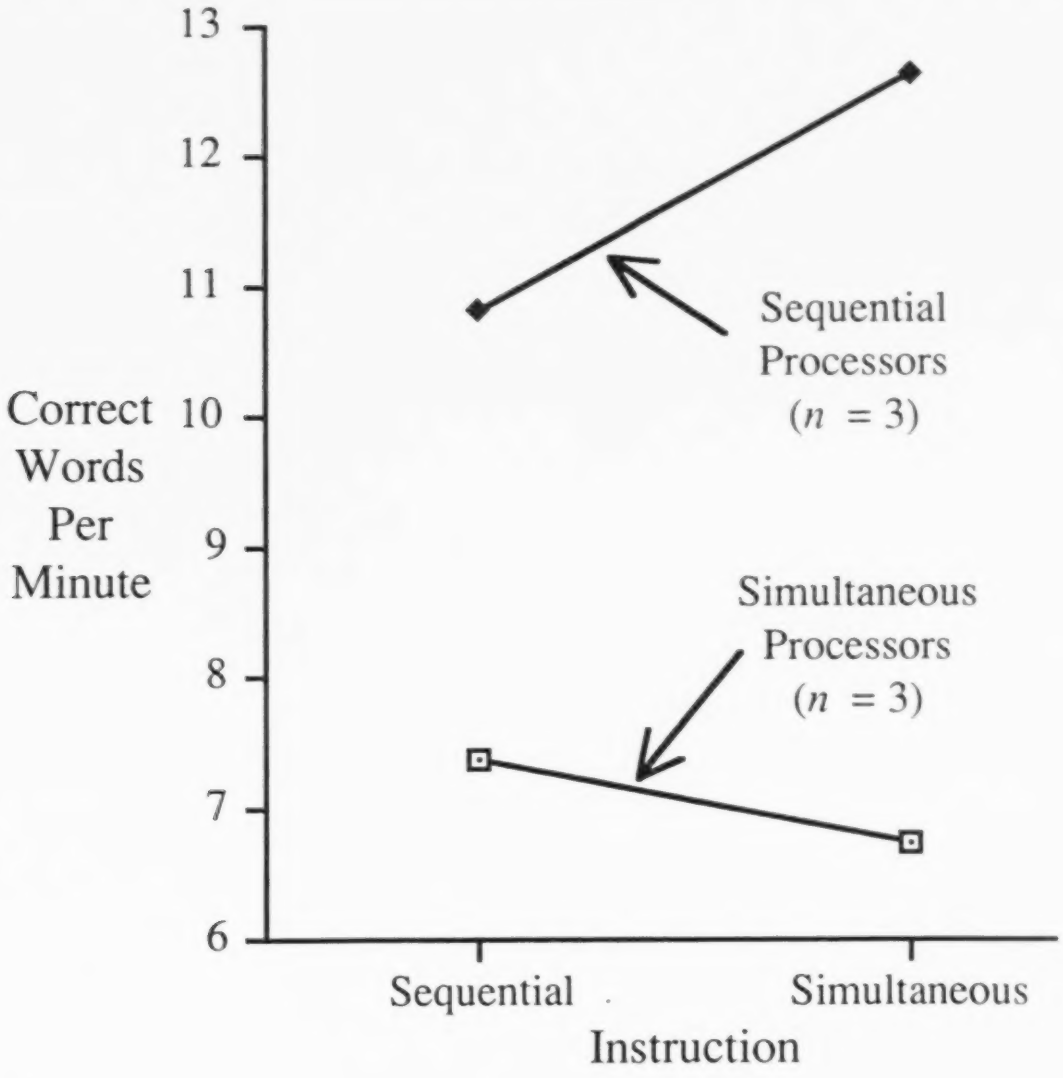
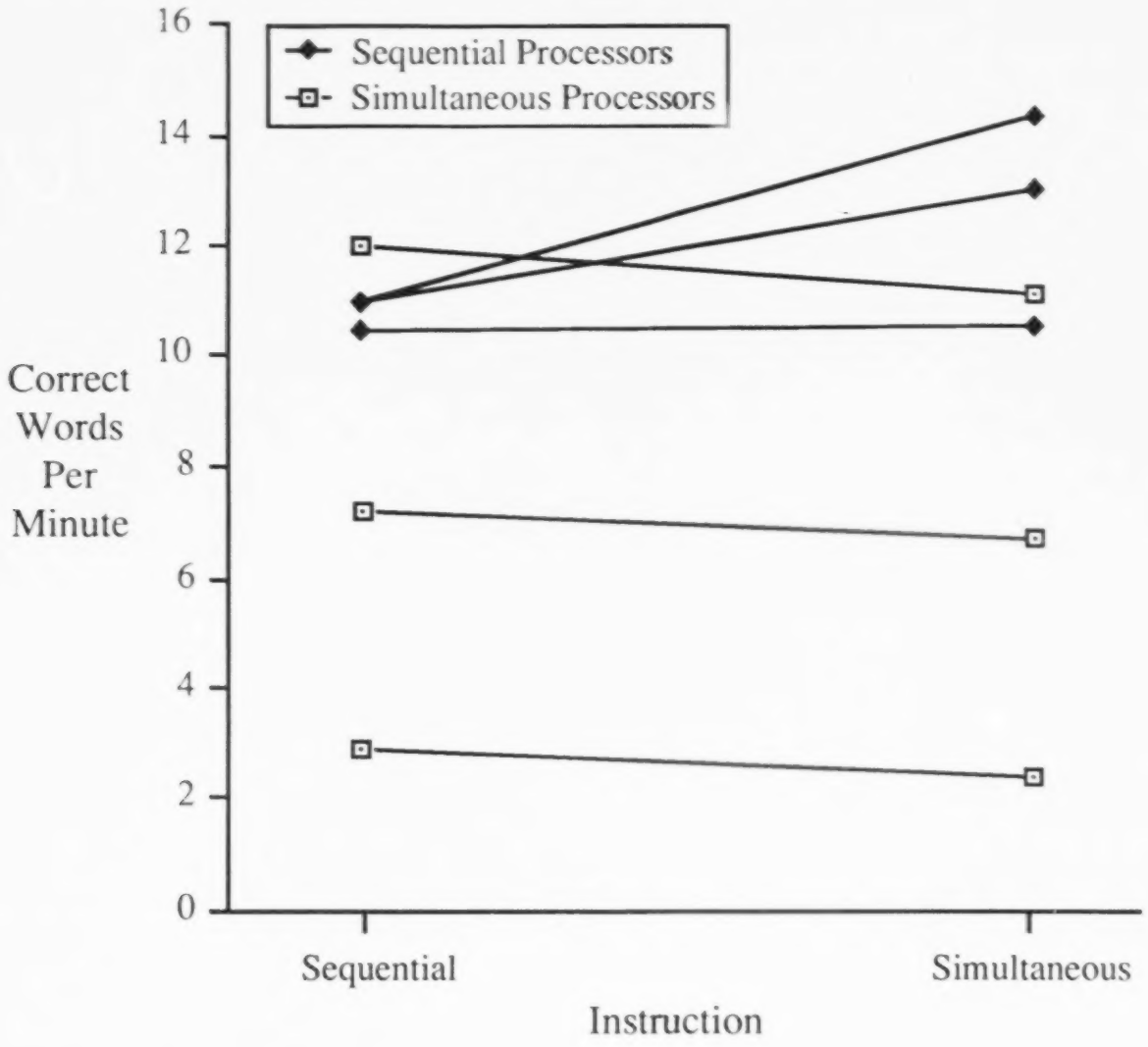


**Figure 2**

*Individual Effects of Sequential and Simultaneous Instruction*



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